



DEPARTMENT OF THE AIR FORCE
AIR FORCE FORCE PROTECTION BATTLELAB
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08 July 2000

MEMORANDUM FOR FPB/FPC (Lt Col Owens)
 FPB/CD (Lt Col Tirevold)
 FPB/CC (Col Springs)

FROM: FPB/FPCE (Capt Jurk)

SUBJECT: Test Report -- TORESS Phase 1 Field Trial at Sandia National Labs.
 -INFORMATION MEMORANDUM

1. PURPOSE. Present the objective and subjective data collected from the Phase 1 field trial.
2. BACKGROUND. The Tele-Operated Remote Engagement and Surveillance System (TORESS) initiative seeks to evaluate the military worth of using a commercial off-the-shelf platform to minimize explosive ordnance disposal (EOD) and security forces (SF) personnel exposure to ordnance generated blast and fragmentation and enemy gunfire respectively. Along with increasing personnel safety through minimizing ones exposure, we will also evaluate whether this platform allows for an increase in weapons accuracy and efficiency.
3. FIELD TRIAL:
 - a. The TORESS Phase 1 field trial took place 13-15 Jun 00, at the Sandia National Laboratories (SNL) Department of Energy (DOE) Central Training Academy ranges, Albuquerque, NM. See appendix A, TORESS Phase 1 Field Trial Trip Report, 19 Jun 00.
 - b. Objectives of Phase 1 and their subsequent findings are listed:
 - (1) Familiarize (EOD) technicians with the TRAP system as a potential standoff munition disruption (SMUD) platform. **Accomplished. See appendix B, Interview.**
 - (2) Determine if the TRAP system can be mounted in an EOD flights Up Armored HMMWV (UA-HMMWV). Specifically, inside the cupola to: a) afford the TRAP fragmentation protection and b) when employed, to mirror how EOD technicians would traditionally perform SMUD operations. **The TRAP T-2 fit inside the UA-HMMWV cupola and allowed sufficient left to right along with up and down (angle of attack) traverse of the weapon for target engagement. See Phase 1 video and figure 1.**



Figure 1 TRAP T-2 fits in existing UA-HMMWV cupola



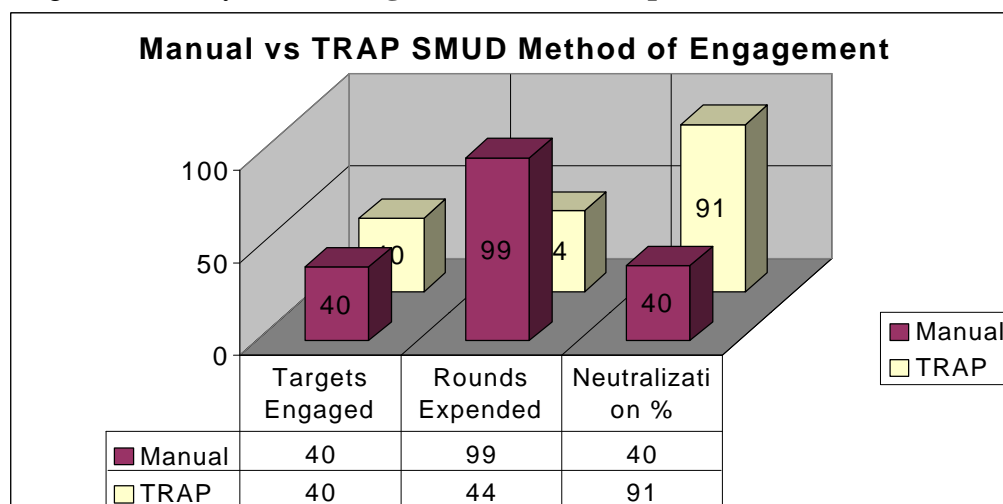
Figure 2 Control unit & color monitor fit between back seats

(3) Determine if an external, color monitor allows easier target acquisition and reduces eye fatigue for the shooter than using the handheld viewer. **The color monitor allowed easy target acquisition and range viewing. See appendix B, Interview, figure 2, and Phase 1 video.**

(4) Determine if the operation can be recorded through the aiming camera and/or the wide-angle surveillance camera. **The recording device (VCR) recorded the images from whichever camera was selected from the handheld control unit, the aiming camera or the wide-angle surveillance camera.**

(5) Determine the optimum configuration, inside the UA-HMMWV, for the TRAP remote control unit and shooter. **The TRAP main control unit fit nicely between the back seats. The monitor also fit between the seats slightly aft of the front seats. See appendix B, Interview and figure 2.**

(6) Measure and record an EOD technician's proficiency (number of rounds required to "SMUD" clay targets or containers of baby powder), firing manually, then again using the TRAP system. **Using the manual "sharp shooter" method it took 99 rounds to**



"neutralize" 40 targets for a 40% hit ratio. Using the TRAP system it took 44 rounds to "neutralize" 40 targets for a 91% hit ratio. See appendix C, Data and figures 3 & 5.

Figure 3 SMUD comparison: EOD firing manually vs. EOD firing the TRAP system

(7) Track how fast an EOD technician can engage and destroy multiple targets at different ranges. **Using the TRAP it averaged 7.5 seconds per round fired. With the manual method it averaged 11 seconds per round fired. See appendix C, Data and figures 3 & 5.**

(8) Track the time EOD spent training on the TRAP system prior to target engagement for data collection. **The two EOD technicians used in this field trial spent approximately 8 hours learning the intricacies of the TRAP platform, how to assemble and mount it in the UA-HMMWV, and fire it using the handheld controller.**

(9) Determine an optimum vehicle firing orientation for sub-munition target engagement. For example, UA-HMMWV facing forward and TRAP pointing forward; or, UA-HMMWV backed up to the range and TRAP pointing to the rear. **Since the TRAP T-2 fit nicely in the UA-HMMWV cupola we oriented the UA-HMMWV so it and the TRAP were facing forward toward the range. This allowed the driver to assist the shooter in spotting the shots and acquiring the targets. See figure 4.**



Figure 4 UA-HMMWV (w/ TRAP in cupola) oriented forward toward range

(10) Collect sufficient numerical and visual information (video and pictures) to help convey the TORESS initiative concept to all required to support it as a Kenney Battlelab Initiative, (i.e., squadron commanders, group commanders, and the director of Air Force Security Forces, and his staff). **Accomplished. See appendix C, Data and Phase 1 video.**

c. Synopsis of the post field test interview with the EOD technicians. The detailed interview is in appendix B. Their overall impression: “TRAP is an accurate sighting and firing platform lending positive value to EOD SMUD operations.” It must be noted however, neither of these EOD technicians had performed SMUD operations before and thus have no baseline to compare the TRAP method against. They provided recommendations to: (1) position the color monitor more forward in the UA-HMMWV cab so both the shooter and spotter (in this case the driver), could use it for target acquisition, spotting, and target assessment. And, (2) modify the UA-HMMWV cupola so the rear hatch has an exterior handle and latch. The current configuration only opens and secures from the inside and does not allow it to be closed and secured when the cupola is not occupied by a person.

4. Please contact me, Capt Jurk, at DSN: 473-0058 x 242, with questions or comments. If I am not available, MSgt Glynn Davis at DSN: 473-0058 x 208, or Mr. Ed Coleman at DSN: 473-0058 x 228 will field any questions or comments.

David M. Jurk

DAVID M. JURK, Capt, USAF
FPB Action Officer

**Appendix A,
TORESS Phase 1 Field Trial Trip Report, 19 Jun 00**

19 Jun 00

MEMORANDUM FOR FPB/FPC (Lt Col Owens)
 FPB/CD (Lt Col Tirevold)
 FPB/CC (Col Springs)

FROM: FPB/FPCE (Capt Jurk)

SUBJECT: Trip Report -- TORESS Phase 1 Field Trial at Sandia National Labs.
 -INFORMATION MEMORANDUM

1. PURPOSE. Conduct the Tele-Operated Remote Engagement and Surveillance System (TORESS) Phase 1 field trial.

2. TRAVELERS. Captain Jurk, David M., Mr. Ed Coleman

3. ITINERARY:

- Depart for Albuquerque, NM, 12 Jun 00.

- Conduct Phase 1 Field Trial, 13-15 Jun 00.

- Return to San Antonio, TX, 16 Jun 00.

4. KEY PERSONNEL CONTACTED. Mr. Ed Schaub, SNL, TRAP Evaluation Project Leader, 505-844-9161; Mr. Ray Page, SNL AF FPB TORESS initiative team leader, 505-844-7100; Mr. Jim Lloyd, SNL AF FPB TORESS initiative team member, 505-844-2357/1951; Mr. Pat Horton, SNL AF FPB TORESS initiative team member, 505-844-1044; Mr. Jim Woods, DOE Central Training Academy (range) POC for TORESS initiative, 505-845-5170; Mr. Warren Benjamin, Production Manager at "The Video Factory," (TORESS initiative Phase 1 POC is Kathryn), 505-888-7616.

5. EXECUTIVE SUMMARY. Over the period of three days, we accomplished the first step of the TORESS proof of concept. We mounted the commercial off-the-shelf Telepresent Rapid Aiming Platform (TRAP) inside an up armored HMMWV (UA-HMMWV) cupola and engaged analogous sub-munition targets at ranges between 60 and 300 yards. A more detailed Phase 1 report will follow and include data, photos, and video of the field test.

**Appendix A,
TORESS Phase 1 Field Trial Trip Report, 19 Jun 00**

6. DISCUSSION:

a. Through this Phase 1 field trial, we accomplished all 10 of our objectives. They ranged from determining if TRAP can be mounted in the UA-HMMWV cupola, to collecting sufficient visual and numerical data to sufficiently convey the worth of our TORESS concept. The objectives will be included in the Phase 1 report.

b. We compared the current manual EOD sharp shooter method to that of using TRAP for engaging the analogous sub-munitions. Observations indicated the TRAP platform can consistently and accurately engage the targets, while using fewer rounds than the manual sharp shooter method.

c. Significantly, trends suggest that using the TRAP platform eliminates the human error associated with individual firing techniques (i.e., trigger pull, breathing pattern, etc...). However, TRAP was only as accurate as the weapon inserted in it. If the weapon was not zeroed for the target engagement range (e.g., 60 to 70 yards), it required the shooter to make point of aim adjustments to effect target destruction.

d. Having accomplished our Phase 1 objectives, we proceeded to establish potential dates and a location for the Phase 2 field trial. The main objective for Phase 2 will be to perform an operational test in a simulated operational environment with operational tactics.

(1) Optimum dates are 24-28 Jul 00, at either Lackland AFB Medina annex ranges, or at the Camp Bullis ranges.

(2) The plan is to have Ray Page, SNL AF FPB TORESS initiative team leader, 505-844-7100, bring the SNL TRAP platform and requisite weapons to San Antonio, TX. We will employ Lackland AFB EOD personnel for this field trial and use two UA-HMMWVs (one from the 820th SFG A-8, and one from Lackland AFB EOD).

(3) We want to invite the Office of Special Technology's EOD/LIC program submunition clearance project manager, and representatives from the NAVEODTECHDIV Air Force component (Air Armament Center Det 63), and the Air Force Civil Engineer Support Agency (AFCESA). Their support of TORESS will be critical as it transitions from successful FPB initiative to the joint EOD community for further testing and eventual service wide implementation.

e. Note that the Phase 1 and 2 field trials employ a 5.56 weapon. This is sufficient for our early field trials. However, Ed Coleman and I are convinced that our ability to successfully prove the TORESS concept to the joint EOD community rests on using their primary standoff munition disruption (SMUD) weapon. That is the Barrett M82A1, .50 caliber sniper rifle.

(1) The difference between the TRAP T-2 and the T-4 is the robustness of the T-4 and its ability to fire .50 caliber weapons. The T-4 will also incorporate engineering enhancements suggested by Sandia as they explored the limitations of their T-2 model.

**Appendix A,
TORESS Phase 1 Field Trial Trip Report, 19 Jun 00**

(2) That said, I contacted Precision Remotes Inc. (PRI), manufacturer of the TRAP, and discussed with them the possibility of changing our order from the T-2 to the TRAP T-4. According to Mr. Graham Hawks, PRI founder and principle engineer, the T-4 is mostly engineered but not built. He feels it will require 4 to 5 months to build and test the T-4. He also indicated the increase in cost to purchase the T-4 should be minimal, as there are no large development costs associated with it. In addition, Graham indicated he is willing to work within our budget constraints to build and deliver the T-4 for us. He asked me to get back with him noting 1) when we need the T-4, 2) what's our budget, and 3) what scope is specifically used by EOD on the M82A1.

7. RECOMMENDATION. Press with all aspects of the Phase 2 field trial. Also, since we have not yet committed to buying the TRAP T-2, change our order to the TRAP T-4. This makes sense because we have the Sandia T-2 to use when they aren't using it, and the T-4 will be essential in proving our TORESS concept to the joint EOD community and the Air Force SF community. I recommend negotiating 3 to 4 months for PRI to build and test the T-4. Also, allowing a \$5,000 increase in the purchase price, if necessary, taking it to \$45,250.

8. Please contact me, Capt Jurk, at DSN: 473-0058 x 242, with questions or comments.

David M. Jurk

DAVID M. JURK, Capt, USAF
FPB Action Officer

Appendix B, Interview

What: Exit Interview with participating AF EOD personnel

When: 16 June 2000, 1000 hrs.

Who: Interviewers: Ray Page, SNL; Ed Coleman, FPB/CSC

Interviewees:

1. A1C Dustin Lambries (experienced shooter) qualified expert twice with M16 (TRAP shooter).
2. A1C Jason Clarendon (inexperienced shooter) qualified expert twice with M16.

Note. Neither A1C Lambries or A1C Clarendon have conducted SMUD operations before. Nor have they fired a .50 caliber weapon before (not pertinent to Phase 1 since the weapon was 5.56)

Where: 377th CEG/CED
2050 Wyoming Blvd SE
Kirtland AFB, NM 87117-5663
505 846-2229

Overall Impressions:

1. TRAP system viewed as a positive asset.
2. Accurate sighting system and firing platform.
3. Easy to transport, setup and use.
4. Malfunctions were minimal.
5. 1-2 days of orientation & training appears sufficient to safely employ system.
6. Hard to make system a completely safe weapon (cannot extract 100 rd magazine with weapon mounted in TRAP).
7. Hand-held eye-piece sight would become tiresome throughout a full day of SMUD ops.
8. Both operators preferred the camera/sight view from the auxiliary monitor (neither shooter really considered the tactical value of the handheld sight in a hostile environment).
9. Spotter essential to SMUD concept, assist in target acquisition, assessment, and relief after long periods of shooting.
10. Employment of shooter/spotter, i.e., two-man concept is critical.

Appendix B, Interview

Shooter Recommendations:

1. Position the auxiliary monitor forward in the HMMWV (vicinity of the radio mounts), to allow shooter and spotter to view target acquisition and assessment.
2. Shock-mount the TRAP system to vehicle contact points.
3. Modify the cupola so that the rear door may be opened from the outside (current configuration locks from the inside, and will not allow the rear door to be closed when unoccupied during shooting, which exposes TRAP system and vehicle occupants to potential SMUD fragments, or hostile fire).

Appendix C, Data

Pistol Range - EOD Technician Firing Manually; 15-20 mph L to R tailwind, gusting to 25 mph

String 1	Acq Mode	Dist. Yards	<u>Tgt No.</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	Tgt total	Rd Total
TOD 1021	E	67	Rds/Tgt	4	3	2	2		4	11
			Time/rd sec.	16.33	62.63	104.4	123.38			
Shooter	engaged	Only 4 tgts	"	25.02	86.72	116.05	137.21			
			"	40.64	96.29					
			"	52.51						
			Time/Sec/Rd	13.1275	14.593333	9.88	10.58			
			Time/Sec/Tgt	52.51	43.78	19.76	21.16			
String 2	Acq Mode	Dist. Yards	<u>Tgt No.</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	Tgt total	Rd Total
	E	67	Rds/Tgt	2	1	5	1	2	5	11
			Time/rd sec.	5.8	22.35	28.72	81.63	90.89		
			"	16.17		34.79		112.5		
			"			42.56				
			"			55.54				
			"			64.36				
			Time/Sec/Rd	8.085	6.18	8.402	17.27	15.435		
			Time/Sec/Tgt	16.17	6.18	42.01	17.27	30.87		
String 3	Acq Mode	Dist. Yards	<u>Tgt No.</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	Tgt total	Rd Total
	E	67	Rds/Tgt	3	1	2	1	1	5	8
			Time/rd sec.	NA	NA	4.43	16.44	20.02		
Timer	Timer		"	NA		10.03				
malfunction	restarted									
on tgts 1&2	on tgt 3									
			Time/Sec/Rd	0	0	5.015	6.41	3.58		
			Time/Sec/Tgt	0	0	10.03	6.41	3.58		
String 4	Acq Mode	Dist. Yards	<u>Tgt No.</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	Tgt total	Rd Total
	E	67	Rds/Tgt	2	1	1	1	3	5	8
			Time/rd sec.	23.53	38	43.34	47.92	54.92		
			"	28.64				59.34		
			"					63.63		
			Time/Sec/Rd	<u>14.32</u>	<u>9.36</u>	<u>5.34</u>	<u>4.58</u>	<u>5.2366666</u>		
			Time/Sec/Tgt	28.64	38	5.34	4.58	15.71		

String 5	Acq Mode E	Dist. Yards 69	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 6	<u>2</u> 2	<u>3</u> 1	<u>4</u> 6	<u>5</u> 6	Tgt total 5	Rd Total 21
			Time/rd sec.	12.84	66.3	109.97	120.48	NA		
			"	23.16	95.75		126.44	199.82		
			"	30.63			150.44	218.76		
			"	37.72			167.53	249.39		
			"	48.94			175.18	256.76		
			"	59.44			187.39	266.21		
			Time/Sec/Rd	<u>9.9066666</u>	<u>18.155</u>	<u>14.22</u>	<u>12.903333</u>	<u>13.136666</u>		
			Time/Sec/Tgt	59.44	36.31	14.22	77.42	78.82		
String 6	Acq Mode E	Dist. Yards 69	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 6	<u>2</u> 1	<u>3</u> 2	<u>4</u> 1	<u>5</u> 1	Tgt total 5	Rd Total 11
			Time/rd sec.	4.46	81.53	96.13	115.91	127.41		
			"	17.44		107.23				
			"	27.21						
			"	35.21						
			"	44.75						
			"	54.46						
			Time/Sec/Rd	<u>9.0766666</u>	<u>27.07</u>	<u>12.85</u>	<u>8.68</u>	<u>11.5</u>		
			Time/Sec/Tgt	54.46	27.07	25.7	8.68	11.5		
String 7	Acq Mode E	Dist. Yards 73	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 3	<u>2</u> 2	<u>3</u> 2	<u>4</u> 1	<u>5</u> 1	Tgt total 5	Rd Total 9
			Time/rd sec.	11.09	32.77	58.27	70.37	78.32		
			"	21.97	45.95	64.14				
			"	27.02						
			Time/Sec/Rd	<u>9.0066666</u>	<u>9.465</u>	<u>9.095</u>	<u>6.23</u>	<u>7.95</u>		
			Time/Sec/Tgt	27.02	18.93	18.19	6.23	7.95		
String 8	Acq Mode E	Dist. Yards 73	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 5	<u>2</u> 8	<u>3</u> 4	<u>4</u> 1	<u>5</u> 2	Tgt total 5	Rd Total 20
			Time/rd sec.	8.27	38.12	105.18	163.41	173.26		
			"	13.1	43.4	113.93		181.6		
			"	22.11	50.32	123.17				
			"	26.42	59.6	129.07				
			"	31.92	68.87					
			"		78.38					
			"		88.1					
			"		95.11					

Pistol Range - EOD Technician Firing TRAP; 15-20 mph L to R tailwind, gusting to 25 mph

String 1 TOD 1300	Acq Mode H	Dist. Yards 67	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 1	<u>2</u> 1	<u>3</u> 2	<u>4</u> 1	<u>5</u> 0	No. Tgts 5	Rds Expended 5
			Time/rd sec.	6.96	12.64	18.75	30.9			
			"			23.48				
			<u>Time/Sec/Rd</u>	<u>6.96</u>	<u>5.68</u>	<u>5.42</u>	<u>7.42</u>			
			<u>Time/Sec/Tgt</u>	<u>6.96</u>	<u>5.68</u>	<u>10.84</u>	<u>7.42</u>			
String 2	Acq Mode H	Dist. Yards 67	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 1	<u>2</u> 1	<u>3</u> 1	<u>4</u> 1	<u>5</u> 1	No. Tgts 5	Rds Expended 5
			Time/rd sec.	10.96	21.9	27.49	33.3	38.32		
			<u>Time/Sec/Rd</u>	<u>10.96</u>	<u>10.94</u>	<u>5.59</u>	<u>5.81</u>	<u>5.02</u>		
			<u>Time/Sec/Tgt</u>	<u>10.96</u>	<u>10.94</u>	<u>5.59</u>	<u>5.81</u>	<u>5.02</u>		
String 3	Acq Mode M	Dist. Yards 67	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 1	<u>2</u> 1	<u>3</u> 3	<u>4</u> 1	<u>5</u> 1	No. Tgts 5	Rds Expended 7
			Time/rd sec.	12.22	17.68	22.53	26.77	40.57		
			"			NA				
			"			NA				
			<u>Time/Sec/Rd</u>	<u>12.22</u>	<u>5.46</u>	<u>4.85</u>	<u>4.24</u>	<u>13.8</u>		
			<u>Time/Sec/Tgt</u>	<u>12.22</u>	<u>5.46</u>	<u>4.85</u>	<u>4.24</u>	<u>13.8</u>		
String 4	Acq Mode M	Dist. Yards 67	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 1	<u>2</u> 1	<u>3</u> 1	<u>4</u> 1	<u>5</u> 2	No. Tgts 5	Rds Expended 6
			Time/rd sec.	9.18	14.64	19.81	25.53	30.05		
			"					33.05		
			<u>Time/Sec/Rd</u>	<u>9.18</u>	<u>5.46</u>	<u>5.17</u>	<u>5.72</u>	<u>3.76</u>		
			<u>Time/Sec/Tgt</u>	<u>9.18</u>	<u>5.46</u>	<u>5.17</u>	<u>5.72</u>	<u>7.52</u>		
String 5 TOD 1415	Acq Mode HV	Dist. Yards 69	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 1	<u>2</u> 1	<u>3</u> 1	<u>4</u> 1	<u>5</u> 1	No. Tgts 5	Rds Expended 5
			Time/rd sec.	19.9	27.12	33.14	38.02	45.4		
			<u>Time/Sec/Rd</u>	<u>19.9</u>	<u>7.22</u>	<u>6.02</u>	<u>4.88</u>	<u>7.38</u>		
			<u>Time/Sec/Tgt</u>	<u>19.9</u>	<u>7.22</u>	<u>6.02</u>	<u>4.88</u>	<u>7.38</u>		
String 6	Acq Mode HV	Dist. Yards 69	<u>Tgt No.</u> Rds/Tgt	<u>1</u> 2	<u>2</u> 1	<u>3</u> 1	<u>4</u> 1	<u>5</u> 1	No. Tgts 5	Rds Expended 6

			Time/rd sec.	19.82	36.53	43.49	51.03	57.97		
			"	30.95						
			<u>Time/Sec/Rd</u>	<u>15.475</u>	<u>5.58</u>	<u>6.96</u>	<u>7.54</u>	<u>6.94</u>		
			<u>Time/Sec/Tgt</u>	<u>30.95</u>	<u>5.58</u>	<u>6.96</u>	<u>7.54</u>	<u>6.94</u>		
String 7	Acq Mode	Dist. Yards	<u>Tgt No.</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	No. Tgts	Rds Expended
	MV	69	Rds/Tgt	1	1	1	1	1	5	5
			Time/rd sec.	9.27	23.27	26.74	31.5	35.96		
			<u>Time/Sec/Rd</u>	<u>9.27</u>	<u>14</u>	<u>3.47</u>	<u>4.76</u>	<u>4.46</u>		
			<u>Time/Sec/Tgt</u>	<u>9.27</u>	<u>14</u>	<u>3.47</u>	<u>4.76</u>	<u>4.46</u>		
String 8	Acq Mode	Dist. Yards	<u>Tgt No.</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	No. Tgts	Rds Expended
	MV	69	Rds/Tgt	1	1	1	1	1	5	5
			Time/rd sec.	9.87	14.45	22.6	28.17	33.69		
			<u>Time/Sec/Rd</u>	<u>9.87</u>	<u>4.58</u>	<u>8.15</u>	<u>5.57</u>	<u>5.52</u>		
			<u>Time/Sec/Tgt</u>	<u>9.87</u>	<u>4.58</u>	<u>8.15</u>	<u>5.57</u>	<u>5.52</u>		
							Total Tgts	Engaged	40	44 Total R
			Targets	Engaged	40	40				
			Rounds	Expended	44	99				
			%	Neutralized	91	40				
		% Improvement	Manual	Vs. TRAP				51		

Appendix C, Data

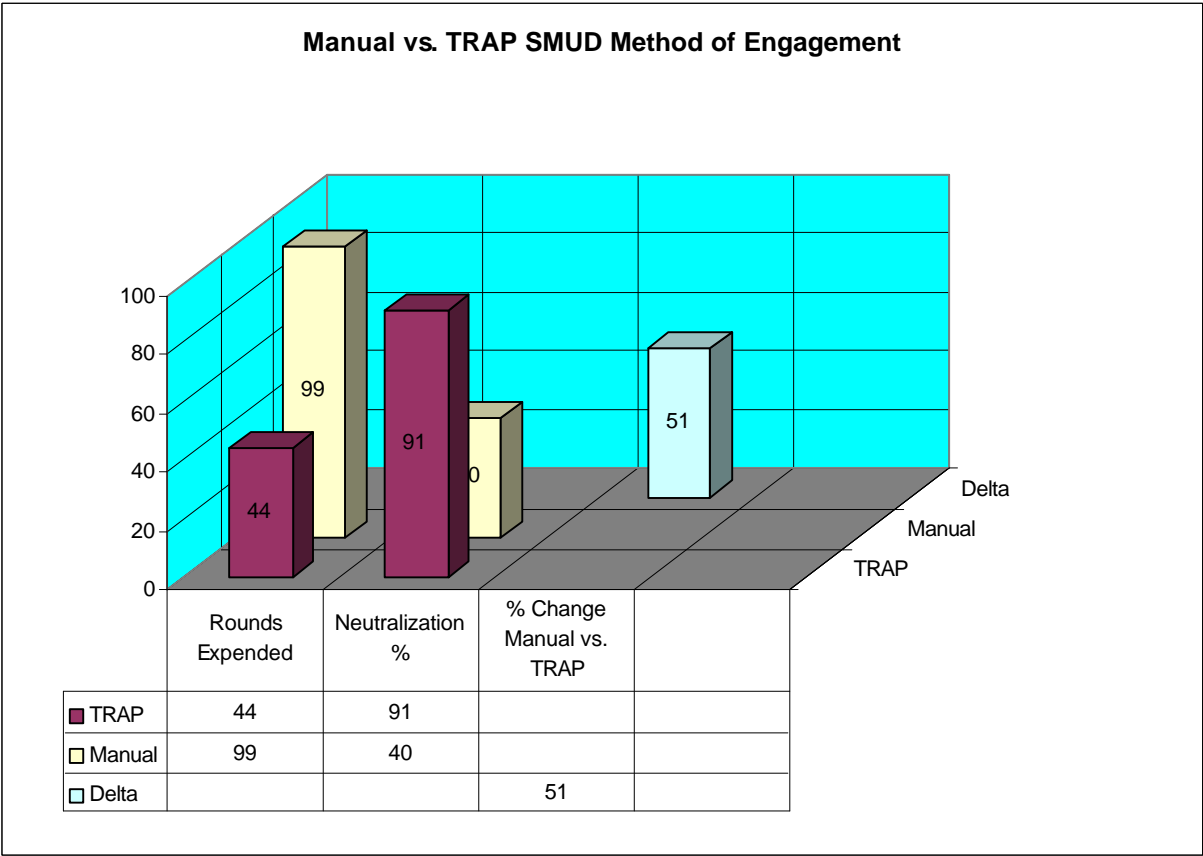


Figure 5 Delta achieved by EOD in using the TRAP system vs the manual SMUD method